- Approaches to a water crossing should be as near to right angles (90 degrees) to the stream direction as possible.

- Climb up slope on a slant or zigzag pattern breaking the grade and avoiding long steep grades on the trail. This will reduce the potential for making gullies.

- Look for alternative skidding using several different skid trails instead of only one primary trail, unless site conditions dictate that using fewer rather than more skid trails will result in less soil disturbance.

- Skidding operations should avoid gullies, seeps, vernal ponds and other permanently wet areas.

- Upon completion of skidding operations, install water bars, particularly on skid trails on sloping and variable topography. If natural vegetation does not quickly establish on these trails, apply grass seed and cover with mulch.

Figure 20. Example of Ephemeral Draw.

12. WETLAND BMPS AND FOREST ROADS

A wetland is characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation, or aquatic life, and is commonly referred to as a bog, swamp, or marsh. As mentioned above in the section on applicable regulations, the following activities are prohibited in wetlands, to protect water quality, unless a Part 303 permit has been obtained from the DEQ:

- Deposit or permit the placing of fill material in a wetland.
- Dredge, remove, or permit the removal of soil or minerals from a wetland.
- Construct, operate, or maintain any use or development from a wetland.
- Drain surface water from a wetland.

Regulated wetlands are defined in Part 303 and associated administrative rules.

Forest Road Construction in Forested Wetlands

Per Part 303, Wetlands Protection, PA 451, of 1994, as amended, the activity of constructing forest roads as part of carrying out silvicultural activities in a wetland environment is exempt from obtaining a Part 303 permit, so long as adverse effects on the wetland are minimized and best management practices as listed below are implemented. These guidelines are for forestry purposes only. If roads are constructed in or through a forested wetland environment for non-forestry purposes, then a wetlands permit may be required**.**

The following are general road construction BMPs, that if applied, will minimize adverse effects on the wetland in question and allow the landowner, forester or logger to be exempt from obtaining a wetlands permit:

- If the crossing can be accomplished at a time when the wetland is relatively dry, construction mats or other temporary crossing methods should be employed. Following the operation, the wetland should be returned to its original condition.
- Conduct timbering operations during winter when the wetland is often frozen and passable and will not require the use of fill or other methods that may permanently damage the wetland.
- If there is an existing roadway through a wetland, that roadway should be utilized, unless upgrading to minimal standards will cause more wetland damage than selecting an alternative route.
- Wetland crossings should be held to the minimum feasible number, width, and total length consistent with the needs only of the forestry operations.
- Wetland crossings should be designed, constructed and maintained in a manner that keeps vegetative disturbance in the wetland to a minimum and prevents the disruption of migration or other movement of fish or wildlife within the wetland or contiguous water.
- Where fill is necessary, it should be taken from uplands and should consist of clean material. Upon placement, it should be stabilized and maintained to prevent erosion into waters or wetlands during and following construction.
- Wetland crossings should include placement of culverts and other structures necessary to insure adequate passage of flow under and through the road without causing excess drainage to upstream or downstream wetland areas. Drainage should be designed to maintain pre-existing hydrology on either side of the road.
- Wetland crossings may not be located in proximity to public water supply intakes or otherwise constructed at a location or in a manner where they would pose a threat to health, safety or welfare, or otherwise be in violation of federal, state or local laws.

BMP Specifications for Forest Road Construction on Organic Wetland Soils

In the federal, multi-agency (U.S. Forest Service, Natural Resource Conservation Service, Army Corps of Engineers, and the Environmental Protection Agency) publication, “Forested Wetlands: Functions, Use and Best Management Practices”, (Forest Service publication number NA-PR-01-95), it recommends different road construction techniques and BMPs, depending on the nature of the wetland soils in which forest management activity is scheduled to occur. One key

component is that roads built on organic wetlands should provide for cross drainage of water on the surface and in the top 12 inches of the soil.

Construction techniques vary, depending on the type of soil involved (mineral versus organic), and where organic soils are involved, the depth of the organic layer. The following practices, which differ based on soil type and thickness, are recommended for wetland road construction:

- For road construction on soils with **organic layers close to 16 inches** in thickness, these are the recommended practices:
  - Place 24 inch diameter culverts with their bottom half in the upper 12 inches of the soil to handle subsurface flows and the top 12 inches to handle above ground flows every 300 feet or so (see Figure 21).

- For road construction on soils with organic **layers in excess of 4 feet** in thickness, these are the recommended practices:
  - The road should be constructed across the top of the soil surface by placing fill material on top of geotextile fabric, while allowing for cross drainage via the use of a 12 inch think layer of porous material such as large stone into the roadbed (see Figure 22). This material should be separated from the adjacent fill layers by geotextile fabric, and be incorporated into the road fill design so as to lie in the top 12 inches of the soil to provide continuous cross drainage.
  - Where such porous layers are not used, place culverts at points where they will receive the greatest support from the soil below.
  - Construct ditches parallel to the roadbed on both sides to collect surface and subsurface water, so as to carry said water through a given culvert. Note that these ditches should be located 3 times the depth of the organic layers from the edge of the road fill.

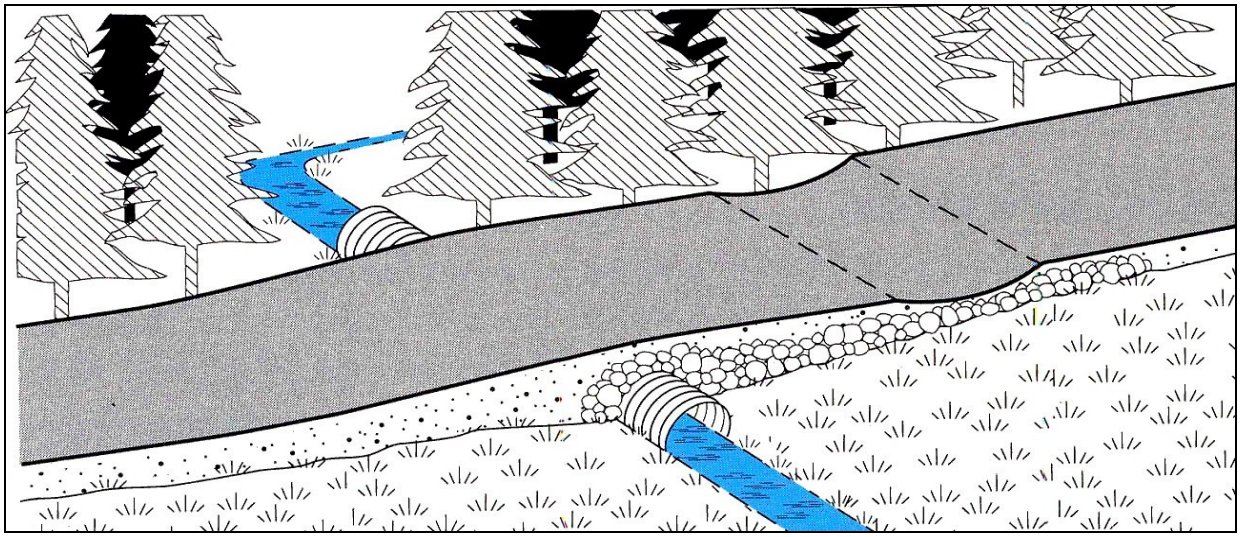

Figure 21. Proper Culvert Installation and Use on a Wetland Road.

(Re-printed courtesy of the United States Forest Service)

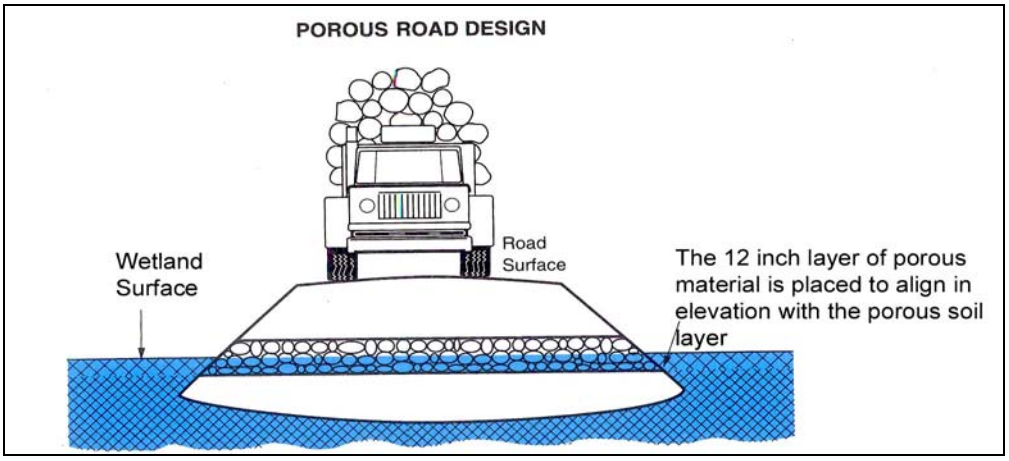

Figure 22. Porous Road Design Using Large Stone.

(Re-printed courtesy of the United States Forest Service)

- For road construction on soils with **organic layers between 16 inches and 4 feet** in thickness, these are the recommended practices:
  - Place fill directly on the peat surface and allow the fill to compress or displace the peat until equilibrium is reached. In this technique, culverts are used instead of porous layers to move flows through road fill material.
  - Place all culverts at the lowest elevation on the road centerline with additional culverts installed as needed to provide adequate cross drainage.
  - Construct all ditches parallel to the road centerline and along the toe of the fill to collect surface and subsurface water flows, carrying said flows through the culvert(s), redistributing the flows to the other side of the road.

Specifications for Roads Constructed on Mineral Soils or a Thin Organic Layer

When roads are being constructed on mineral soils or on those soils with surface organic layers less than 16 inches in thickness, the following are the recommended practices:

- Roads through mineral soil wetlands can be constructed using normal road construction techniques. Apply geotextile fabric first before adding fill to increase bearing strength of the road and to preserve the bearing strength of fill material so as to prevent mixture with fine soil particles.

- In mineral soil wetlands, a culvert should be placed at the lowest elevation on the road centerline with additional culverts as needed to provide adequate cross drainage (see Figure 21 and 23).

- Shallow ditches parallel to the road centerline should be constructed along the toe of the fill to collect surface and subsurface water flows, carrying flows through the culvert(s) to the other side of the road and into a vegetated area (see Figure 23). Any ditches must be of depth and width only to allow cross drainage and support the stability of the road. **Deeper or excessive ditching will require a permit from the DEQ.**

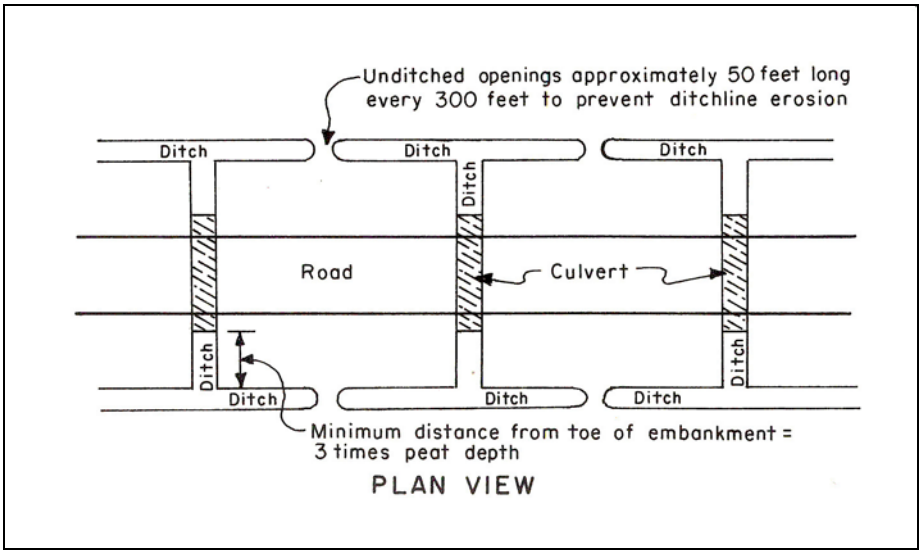

Figure 23. Illustration of Use and Placement of Culverts and Ditches for Wetland Roads.

13. FOREST ROADS - CONTROLLING SEDIMENT MOVEMENT AND TRANSPORT DURING RAIN EVENTS

During rain events, excessive water flows can erode a forest road causing sediment to be eventually transported into a stream or other water body. Described below are various devices that can help mitigate erosion and sediment movement. These devices work by interrupting the flow of water and sediment, causing the sediment to be deposited, trapped or filtered out before reaching an open water body. Establishing a maintenance schedule following rain events is key to the proper functioning of these devices.

Described below are examples of such control devices:

- **Erosion Barriers** – Pre-seeded erosion control products at the toe slope of a road and at the outlets of culverts, diversion ditches, water bars, or broad-based dips, or the use of rock or large stone (an average diameter of 6 inches) placed on the toe of road and outlet of the diversion structures should be the first choices. While cheap and handy, laying down slash is not very good in reducing the velocity and erosive impacts of concentrated flows during significant rainfall events.

- **Silt Fence** – A geotextile fabric, when installed properly, has the capability of retaining most suspended materials, (e.g. sediment) and releasing the filtered runoff through the fabric. Do not use in permanent flowing streams or in any location with concentrated flows. See Figure 5 for an illustration of how to properly install silt fence. It is most commonly installed at or beyond the toe of a slope to trap sediment coming from overland sheet flows during a storm event. Silt fence must be installed along the same elevation contours across the slope to prevent runoff from flowing around the fence. For long slopes or large areas, silt fence should be installed parallel to each other in a series with an average spacing of 200 feet and drain no more than one-half acre per 100 feet of fence.